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AUTHOR Reddy, Jean: And Others
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ABSTRACT

This Algebra II curriculum guide, produced under the direction of the State of Louisiana Department of Public Education, is a segment of the educational program established in response to accountability, assessment, and competency-based education laws. This guide is designed to represent the best thinking of a selected statewide committee established to determine the scope of mathematics content for a second-year algebra course at the secondary level. The guide contains: (1) the membership rosters of the committees involved in developing the material: (2) a review of the curriculum development process: (3) eight required goals that students completing the Algebra II course should be able to reach: (4) a complete curriculum outline with performance objectives: and (5) a detailed set of activities grouped with specific objectives and content areas for Algebra II. (MP)

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ALGEBRA II.

CURRICULUM GUIDE

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J. Kelly Nix

State Superintendent

SE 033 161

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ALGEBRA II CURRICULUM GUIDE

Issued by

Division of Academic Programs

J. KELLY NIX

State Superintendent

NOV 7 1980

TABLE OF CONTENTS

FOREWORD	ii
ACKNOWLEDGMENTS	iii
STATEWIDE MATHEMATICS CURRICULUM COMMITTEE	iv
ACTIVITIES COMMITTEE	v
PILOT COMMITTEE	vi
INTRODUCTION	vii
GOALS	1
PACING CHART	2
CURRICULUM OUTLINE AND PERFORMANCE OBJECTIVES	3
I. Real Number System	4
II. Equations and Inequalities	7
III. Complex Number System	9
IV. Relations, Functions and Conic Sections	11
V. Exponential and Logarithmic Functions	14
ACTIVITIES	16
I. Real Number System	17
II. Equations and Inequalities	26
III. Complex Number System	35
IV. Relations, Functions and Conic Sections	41
V. Exponential and Logarithmic Functions	49
BIBLIOGRAPHY	56

FOREWORD

Curriculum guides have been developed for each mathematics course at the secondary level and for grades K-8 at the elementary level. These guides represent the best thinking of a selected statewide committee established to determine the scope of mathematics content which should be taught at each level.

The mathematics curriculum guides are another segment of the total educational program established by this administration and mandated by the Legislature in both the accountability and assessment and the competency-based education laws. This educational program requires that specific skills and concepts be established for each grade level and for each subject area. The mathematics curriculum guides with course outlines, performance objectives and coordinated activities effect this phase of the program.

It is hoped that the guides will make a major contribution to the improvement of mathematics instruction in the schools of Louisiana. This is another step toward achieving the goals of this administration.

FOR OUR CHILDREN

J. KELLY NIX

ACKNOWLEDGMENTS

The statewide mathematics committee is to be commended for its work in the development of the Mathematics Curriculum Guides K-12. The committee worked under the chairmanship of Dr. Jean Reddy, Section Chief of the Mathematics Section in the Bureau of Secondary Education.

The Bureaus of Elementary Education and Secondary Education were responsible for writing the activities component of the Mathematics Curriculum Guides. The elementary supervisors in the Bureau of Elementary Education with Mrs. Bonnie Ross serving as chairman of the committee, developed the activities for the K-8 guide. The activities for the secondary guides were drafted by a committee under the leadership of Dr. Jean Reddy. These people are to be commended for their colossal accomplishments in this formidable project.

Robert Gaston, Ed.D
Assistant Superintendent
for Academic Programs

E. Ray Reech
Executive Director of Instruction

Eugene Millet
Director of Secondary Education

STATEWIDE MATHEMATICS CURRICULUM WRITING COMMITTEE

Dr. Jane Abshire
Mathematics Supervisor
Vermilion Parish School Board
Abbeville, La 70510
(318) 893-3973

Mrs. Ruth Atherton
Baton Rouge Magnet School
Baton Rouge, La 70806
(504) 383-0520

Mrs. Annette Ballard
Elementary Consultant
Calcasieu Parish School Board
Lake Charles, La 70601
(318) 433-6321

Dr. Myrna L. Bond
1320 Brocade Street
Baton Rouge, La 70815
(504) 924-1320

Mrs. Olympia Boucree
Mathematics Supervisor
Orleans Parish School Board
New Orleans, La 70122
(504) 288-6561

Mrs. Patsy Ann Bullock
Glen View Junior High School
Ruston, La 71270
(318) 255-5724

Mr. James E. Ferguson
Ruston High School
Ruston, La 71270
(318) 255-0807

Mrs. June Harper
McKinley Middle School
Baton Rouge, La 70802
(504) 344-5187

Mrs. Suanne Jacobs
Sam Houston High School
Lake Charles, La 70601
(318) 855-3528

Mrs. Jane Johnston
West Monroe High School
West Monroe, La 71291
(318) 323-3771

Mrs. Margaret Kennedy
Grand Lake Elementary School
Lake Charles, La 70601
(318) 598-2231

Mrs. Ida V. King
West Monroe High School
West Monroe, La 71291
(318) 323-3771

Mrs. Marion King
Istrouma High School
Baton Rouge, La 70805
(504) 355-7701

Mrs. Pearl Leach
Cameron Parish School Board
Cameron, La 70631
(318) 775-5784

Mr. Lewis C. Martin
Epps High School
Epps, La 71237
(318) 926-3624

Ms. Theresa M. Martinez
South Cameron High School
Creole, La 70632
(318) 542-8560

*Dr. Jean Reddy
Section Chief/Mathematics
State Department of Education
P. O. Box 44064
Baton Rouge, La 70804
(504) 342-3417

Mr. Otto Sellers
Captain Shreve High School
Shreveport, La 71105
(318) 865-7137

Mrs. Patricia Valentine
Kiroli Elementary School
West Monroe, La 71291
(318) 325-4862

Mr. Henry Wilson
Transylvania Elementary School
Lake Providence, La 71286
(318) 559-2655

Dr. Elton Womack
P. O. Box 97
Hall Summit, La 71034
(318) 932-5156

* Chairman

ACTIVITIES COMMITTEE

Secondary Mathematics Curriculum Guides

Dr. Jack Garon
L.S.U. Laboratory School
Baton Rouge, La 70803
(504) 388-3221

Mrs. Pearl Leach
Cameron Parish School Board
Cameron, La 70631
(318) 775-5784

Ms. Theresa M. Martinez
South Cameron High School
Creole, La 70632
(318) 542-8560

*Dr. Jean Reddy
Section Chief/Mathematics
Louisiana State Department of Education
P. O. Box 44064
Baton Rouge, La 70804
(504) 342-3417

Dr. Elton Womack
P. O. Box 97
Hall Summit, La 71034
(318) 932-5156

* Chairman

Pilot Committee

Algebra II Curriculum Guide

*Aaron L. Andrepoint
Sulphur High School
Sulphur, La 70663
(318) 527-6679

Loyce Bradford
Jena High School
Jena, La 71342
(318) 992-5195

Irvin Franklin
Booker T. Washington Sr. High
New Orleans, La 70112
(504) 522-3939

Winnie T. Gallagher
Plaquemine High School
Plaquemine, La 70764
(504) 687-6367

Cherylene Huie
Bossier High School
Bossier, La 71111
(318) 222-9424

Jane Johnston
West Monroe High School
West Monroe, La 71291
(318) 323-3771

Marie D. Lanclos
Leonville High School
Leonville, La 70551
(318) 879-2385

Karla N. Madison
Salmen High School
Slidell, La 70458
(504) 643-7359

Rose M. Mathieu
Hahnville High School
Boutte, La 70039
(504) 758-7537

Virgie Pierce
South Terrebonne High School
Houma, La 70360
(504) 868-7850

* Chairman

INTRODUCTION

Act 750 of the 1979 Louisiana Legislature established the Louisiana Competency-Based Education Program. One of the most important provisions of Act 750 is the mandated "development and establishment of statewide curriculum standards for required subjects for the public elementary and secondary schools of this state...." The "statewide curriculum standards for required subjects" is defined as "the required subjects to be taught, curriculum guides which contain mimimum skills and competencies, suggested activities, suggested materials of instruction, and minimum required time allotments for instruction in all subjects." Act 750 further provides that the "effective implementation date of the statewide curriculum standards for required subjects shall be the 1981-82 school year. Development of such curriculum shall begin by the 1979-80 school year."

During the 1978-79 school year, curriculum guides were developed by advisory and writing committees representing all levels of professional education and all geographic areas across the State of Louisiana for the following mathematics courses:

> Algebra I, Algebra II, Geometry, Advanced Mathematics, and Trigonometry.

The major thrust of the curriculum development process in each of the guides has been the establishment of minimum standards for student achievement. Learning expectancies for mastery have been determined for each course and/or grade level. In addition, content outlines, suggested activities, procedures, and bibliographies have been developed as aids in support of the learning expectancies. The curriculum guides also contain activities designed to stimulate learning for those students capable of progressing beyond the minimums.

During the 1979-80 school year, the curriculum guides were piloted by teachers in school systems representing the different geographic areas of the state as well as urban, suburban, inner-city, and rural schools. The standard populations involved in the piloting reflected also the ethnic composition of Louisiana's student population. Participants involved in the piloting studies utilized the curriculum guides to determine the effectiveness of the materials that were developed. Based upon the participants' recommendations at the close of the 1979-80 pilot study, revisions were made in the curriculum guides to ensure that they are usable, appropriate, accurate, comprehensive, relevant, and clear.

The curriculum guides are now ready for full program implementation. This stage must be understood in its operational context. The curriculum developers and the participants in the pilot studies do not stand alone in promoting learning expectancies that will improve education for the students in the State of Louisiana. Ultimately, local system supervisors, principals, and classroom teachers will have the responsibility for attaining this goal.

As curriculum guides are implemented, the following guidelines should prove helpful:

> ...curriculum standards should be considered as the foundation for the year's instructional program. Where other programs are already in operation, these curricular materials must be checked with the foundation curricula to ensure that appropriate course and/or grade level standards are included and maintained.

...curricular activities contained in the guides provide a number of suggestions for helping students to achieve the established standards. Activities to meet the needs of "average," "below average," and "above average" students have been included. These activities should prove helpful as the teacher plans and organizes instruction. Additional activities, however, may supplement or be used in lieu of those listed in the guide as long as these activities are designed to achieve similar specific objectives.

...curricular suggestions for meeting the needs of the special child have been prepared by the Division of Special Education. These suggestions are designed to provide help for teachers who work with special children in the regular classroom.

The continued effort of mathematics teachers to provide quality instruction will enhance our statewide goal to ensure that every student in the public elementary and secondary schools of the State of Louisiana has an opportunity to attain and to maintain skills that are considered essential to functioning effectively in society.

J. KELLY NIX
State Superintendent of Education

GOALS

Upon completion of a secondary course in Algebra II, a student will be able to:

1. Understand the structure of algebra.
2. Perform multiple operations on real numbers and algebraic expressions.
3. Acquire skills in finding the solution set of linear and quadratic equations and inequalities.
4. Perform multiple operations on complex numbers.
5. Demonstrate a basic understanding of conic sections given sufficient data.
6. Acquire skills in performing operations on polynomials.
7. Solve problems that involve exponential and logarithmic functions.
8. Develop a basic understanding of functions and inverse functions.

Algebra II

PACING CHART

The following pacing chart contains suggested periods of time to devote to each major topic in the mandatory portion of this curriculum guide. Since students learn at different rates and days are lost during the school year for various reasons, this pacing chart is based on 33 weeks of school. This provides three weeks of school to utilize as "pad" time in allowing for the factors affecting pacing. Should a group of students complete the mandatory material prior to the end of school, this guide provides ample optional and supplemental material to use as enrichment.

TOPIC	NUMBER OF WEEKS
I. Real number system	6
II. Equations and inequalities	8
III. Complex number system	9
IV. Relations, functions and conic sections	8
V. Exponential and logarithmic functions	2

CURRICULUM OUTLINE AND PERFORMANCE OBJECTIVES

NOTE: All items are mandatory unless preceded by an asterisk. All items with an asterisk should be taught if times permits (See Pacing Chart).

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
I. Real Number System	
A. Fundamental axioms	A. To demonstrate an understanding of the real number system, the student will be able to express, recognize and use:
	1. Axioms of equality;
	2. Axioms of closure;
	3. Commutative axioms;
	4. Associative axioms;
	5. Additive axiom of 0;
	6. Axiom of opposites;
	7. Axiom of the opposite of a sum;
	8. Distributive axiom;
	9. Multiplicative axiom of 1;
	10. Multiplicative axiom of 0;
	11. Multiplicative axiom of -1;
	12. Axiom of Opposites of Products;
	13. Axiom of Reciprocals.
B. Real Numbers	B. To demonstrate a working knowledge of real numbers, the student will be able to:
1. Definition and Classification	1. Define and classify real numbers as either rational or irrational;
2. Absolute value	2. Find the absolute value of any real number;
3. Operations	3. Add, subtract, multiply, and divide real numbers;

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
4. Simplifying expressions	4. Simplify a numerical expression by performing the indicated operations in proper order.
C. Algebraic expressions	C. To demonstrate a basic knowledge concerning algebraic expressions, the student will be able to:
1. Definitions	1. Define the mathematical terms: (a) Variable (b) Term (c) Coefficient (d) Exponent (e) Monomial (f) Binomial (g) Trinomial (h) Polynomial
2. Laws of exponents	2. Express, recognize, and use the laws of exponents to simplify expressions;
3. Operations	3. Add, subtract, multiply, and divide algebraic expressions;
4. Synthetic division and evaluating	4. Use synthetic division;
5. Simplifying expressions	5. Simplify and evaluate algebraic expressions for given values of the variable(s);
6. Simple equations and inequalities	6. Use axioms of real numbers to find the solution set for simple equations and inequalities.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
D. Factoring	D. To demonstrate a basic understanding of factoring, the student will be able to:
1. Special products	1. Determine special products: (a) $(a + b)^2$ (b) $(a - b)^2$ (c) $(a + b + c)^2$ (d) $(a + b)(a^2 - ab + b^2)$ (e) $(a - b)(a^2 + ab + b^2)$ (f) $(a + b)^3$ (g) $(a - b)^3$ (h) $(a + b)(a - b)$
2. Prime factorization	2. Determine prime factors: (a) Find the greatest common factors (b) Find the prime factorization of selected polynomials (product of "special products" above)
3. Remainder and factor theorem	3. Apply the remainder and factor theorem.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
II. Equations and Inequalities	
A. Equations	A. To demonstrate a basic understanding of linear equations and quadratic equations, the student will be able to:
1. Linear solutions and graphs	1. Find three ordered pairs that satisfy a linear equation in two variables and graph;
2. Slope of segments and lines	2. Find the slope of segments and lines given: (a) Two points (b) Equation of a line
3. Graphs	3. Graph a line given: (a) The slope of a line and its y-intercept (b) A point of the line and its slope
4. Equations of lines	4. Find an equation of a line given: (a) The slope of a line and its y-intercept (b) The coordinates of two points of a line (c) The coordinates of a point of the line and its slope
5. Parallel and perpendicular lines	5. Find an equation of: (a) A line parallel to a given line through a given point (b) A line perpendicular to a given line through a given point

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
6. Classification of linear systems	6. Classify a system of two linear equations in two variables as consistent, dependent, or inconsistent, and give a geometric interpretation of the classification;
7. Solutions of linear systems	7. Determine the solution set of a system of two or three linear equations in two or three variables by: (a) Linear combinations (b) Substitution * (c) Cramer's Rule
8. Rational expressions	8. To demonstrate a basic understanding of rational expressions, the student will be able to perform fundamental operations on fractions;
9. Fractional equations	9. Solve fractional equations;
10. Applications	10. Translate verbal expressions into algebraic equations.
B. Inequalities	B. To demonstrate a basic understanding of inequalities, the student will be able to:
1. Linear inequalities	1. Solve and graph linear inequalities;
2. System of linear inequalities	2. Find the solution set of a system of linear inequalities by graphing;
3. Rational inequalities	3. Find the solution set of rational inequalities;
4. Absolute value inequalities	4. Find the solution set of inequalities that involve absolute value.

* Optional

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
III. Complex Number System	
A. Roots and radicals	A. To demonstrate a basic understanding of roots and radicals, the student will be able to:
1. Real roots and principal root	1. Determine whether a real number "a" has real nth roots (for a positive integer n) and if it does, identify the principal nth root;
2. Simplifying radicals	2. Simplify radical expressions.
B. Imaginary numbers	B. To develop a basic understanding of imaginary numbers, the student will be able to:
1. Definition	1. Define a pure imaginary number;
2. Operations	2. Perform operations on pure imaginary numbers.
C. Complex numbers	C. To develop a basic understanding of complex numbers, the student will be able to:
1. Definition	1. Define complex numbers and write in standard form;
2. Solution of quadratic equations	2. Find the roots of a quadratic equation by: (a) Factoring (b) Completing the square (c) Applying the quadratic formula
3. Quadratic inequalities	3. Solve and graph a quadratic inequality;
4. Nature of the roots	4. Find the discriminate of a quadratic equation and use it to determine the nature of the roots;
5. Root-coefficient relations	5. Find the sum and product of roots of quadratic equations;

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
6. Determination from roots	6. Write a quadratic equation given its roots.
D. Radical Equations	D. To develop an understanding of radical equations, the student will be able to solve an equation that contains one or more radicals.
E. Variations	E. To develop an understanding of variations, the student will be able to solve simple problems involving direct and inverse variations.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
IV. Relations, Functions and Conic Sections	
A. Relations and functions	A. To develop a basic understanding of relations and functions, the student will be able to:
1. Definition and indentification	1. Define, identify and illustrate the listed mathematical terms: (a) Relations (b) Function (c) Domain (d) Range
2. Graphing	2. Sketch the graphs of selected functions and relations.
B. Polynomial functions	B. To demonstrate a basic understanding of polynomial functions, the student will be able to:
1. Definition	1. Define a polynomial function and determine its degree;
2. Operations	2. Perform the four basic operations along with the composite and inverse functions.
C. Conic sections	C. To demonstrate a basic understanding of the conic sections, the student will be able to:
1. Concept	1. Visualize a conic section as the intersection of a plane and a cone;
2. Distance and midpoint formulas	2. (a) Find the distance between two points; (b) Find the coordinates of the midpoint of a segment.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
3. Identification	3. Determine if the graph of a quadratic equation in two variables is: (a) A parabola (b) A circle (c) An ellipse (c) A hyperbola
4. Analysis	4. Analyze a quadratic equation that describes a conic section and where applicable, find: (a) The coordinates of its center (b) The vertices (c) The foci (d) Equations of directrices (e) Equations of asymptotes (f) Equations of axes
5. Graph	5. Sketch the graphs of conic sections;
6. Equations	6. Find equations of conic sections from given data.
D. Solution of linear-quadratic systems	D. To develop a basic understanding of linear-quadratic systems, the student will be able to:
1. Graphical method	1. Find solution(s) or approximate solution(s) of a system of linear-quadratic equations in two variables by graphing;
2. Algebraic method	2. Use algebraic techniques to find the solution set of a system of linear-quadratic equations in two variables.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
E. Quadratic relations	E. To develop a basic understanding of conics, the student will be able to graph and solve algebraically quadratic relations in two variables.
F. Quadratic inequalities	F. To develop a basic understanding of quadratic inequalities, the student will be able to graph quadratic inequalities in two variables.

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
V. Exponential and Logarithmic Functions	
A. Exponential function	A. To develop a basic understanding of exponential functions, the student will be able to:
1. Definition	1. Define an exponential function;
2. Graph	2. Graph an exponential function.
B. Logarithms	B. To develop a basic understanding of logarithms, the student will be able to:
1. Definition	1. Define logarithm to base b;
2. Laws	2. Use the laws of logarithms and the definition of a logarithm to:
	(a) Convert an equation in logarithmic form to an equation in exponential form
	(b) Convert an equation in exponential form to an equation in logarithmic form
3. Functions	3. Define a logarithmic function and:
	(a) Find the domain and range of a logarithmic function
	(b) Graph logarithmic functions
4. Comparison of graphs	4. Explain how the graphs of a logarithmic function and its inverse are related to the graph of $y = x$;
* 5. Common logarithms	* 5. Find the characteristic of common logarithms and use a table to determine the mantissa of a logarithm;
* 6. Antilogarithm	* 6. Find a number x given the common logarithm of x;

* Optional

CURRICULUM OUTLINE	PERFORMANCE OBJECTIVES
7. Applications	7. Use logarithms to perform various operations on numbers;
8. Equations	8. Solve equations of the form $a^x = b$; a and b real numbers.

ACTIVITIES

ACTIVITIES

I. A. CONTENT: Real Number System; Fundamental Axioms

OBJECTIVE: The student will be able to express, reconize and use:

(a) Axioms of equality;

(b) Axioms of closure;

(c) Commutative axioms;

(d) Associative axioms;

(e) Additive axiom of 0;

(f) Axiom of opposites;

(g) Axiom of the opposite of a sum;

(h) Distributive axiom;

(i) Multiplicative axiom of 1;

(j) Multiplicative axiom of 0;

(k) Multiplicative axiom of -1;

(l) Axiom of opposites of products;

(m) Axiom of reciprocals.

ACTIVITIES: Name the property of the real number system illustrated by each statement.

(a) $3 + 2 = 2 + 3$

(b) $(5 \times a) \times b = 5 \times (a \times b)$

(c) $x + (-x) = 0$

(d) $4 \times (a + b) = (4 \times a) + (4 \times b)$

(e) $3 \times \frac{1}{3} = 1$

(f) $3 \times (4 \times 5) = (3 \times 4) \times 5$

(g) $3 \times (4 \times 5) = (4 \times 5) \times 3$

I. B. (1) CONTENT: Real Number System; Real Numbers; Definition and Classification

OBJECTIVE: The student will be able to define and classify real numbers as either rational or irrational.

ACTIVITIES: Classify each number as rational or irrational.

(a) .2753

(b) $.27\overline{53}$ . . .

(c) $\sqrt{3}$

(d) $\frac{7}{8}$

(e) $\sqrt{4}$

(f) .2020020002 . . .

I. B. (2) CONTENT: Real Number System; Real Numbers; Absolute Value

OBJECTIVE: The student will be able to find the absolute value of any real number.

ACTIVITIES: Find the absolute value of each number.

(a) $|2|$ = _____

(b) $|-10|$ = _____

(c) $|0|$ = _____

(d) $|b|$ = _____ if $b < 0$

(e) $|2 + (-3)|$ = _____

I. B. (3) CONTENT: Real Number System; Real Numbers; Operations

OBJECTIVE: The student will be able to add, subtract, multiply and divide real numbers.

ACTIVITIES:

(a) (+15) + (+3)

(b) (-16) + (+16)

(c) (+3) - (-3)

(d) 15 ÷ (-5)

(e) (2)(-3)

(f) (-3)(-2)

(g) (-20) ÷ (-5)

(h) (-10) ÷ (-3)(+2)

I. B. (4) CONTENT: Real Number System; Real Numbers; Simplifying Expressions

OBJECTIVE: The student will be able to simplify a numerical expression by performing the indicated operations in proper order.

ACTIVITIES: Evaluate.

(a) 12 + 5 - 4

(b) (-28) ÷ (7) (-9)

(c) 16 + 12 ÷ (-2)

(d) 5 - 4 x 6

(e) {35 - (-15)} ÷ 5

(f) 24 ÷ (2x3) + 6 x (2 x 3)

(g) 48 ÷ (2 - 6) + 18 ÷ (2 x 3)

I. C. (1) CONTENT: Real Number System; Algebraic Expressions; Definitions

OBJECTIVE: The student will be able to define:

(a) Variable;

(b) Term;

(c) Coefficient;

(d) Exponent;

(e) Monomial;

(f) Binomial;

(g) Trinomial;

(h) Polynomial.

ACTIVITIES:

Match:

(a) Binomial	(1) An expression of the form ax^n where a is a real number and n is a positive integer.
(b) Coefficient	(2) The sum of two monomials.
(c) Exponent	(3) A symbol that holds a place for an element in a set.
(d) Monomial	(4) The sum of three monomials.
(e) Polynomial	(5) Indicates the number of times a factor is used.
(f) Term	(6) Each of the factors in a product.
(g) Trinomial	(7) Any combination of products and quotients.
(h) Variable	(8) A monomial or the sum of two or more monomials.

I. C. (2) CONTENT: Real Number System; Algebraic Expressions

OBJECTIVE: The student will be able to express, recognize, and use the laws of exponents to simplify expressions.

ACTIVITIES: Simplify.

(a) $x^2 \cdot x^5$

(b) $(x^2)^5$

(c) $(xy)^5$

(d) $\frac{x^5}{x^2}$

(e) $\frac{x^3}{x^3}$

(f) $16^{\frac{3}{2}}$

(g) $\frac{2x^{-2}y^3}{4x^3y^5}$

(h) $\frac{x^{-3}y^{-6}}{x^{-3}y^{-5}}$

(i) $\left(\frac{2ab^2}{c^6}\right)^5$

(j) $\left(\frac{2x^2}{y^3}\right)^3$

(k) $\left(\frac{-5a^3}{b^{-2}c^{-3}}\right)^{-2}$

(l) $\left(\frac{3}{4}\right)^{-2}$

(m) $\left(\frac{3x^{-2}y}{6x^3y^{-2}}\right)^{-3}$

I. C. (3) CONTENT: Real Number System; Algebraic Expressions; Operations

OBJECTIVE: The student will be able to add, subtract, multiply, and divide algebraic expressions.

ACTIVITIES:

Perform the indicated operations.

(a) $a + 3a + 7a$

(b) $9y + (-3y)$

(c) $5b + (3b)(-5)$

(d) $(2x^2 + 3x - 6) + (5x^2 - 10x - 4)$

(e) Subtract $(5x^2 - 10x - 4)$ from $(2x^2 + 3x - 6)$

(f) $(2x^2 + 3x - 6)(5x^2 - 10x - 4)$

(g) $(a^3 - 64) \div (a - 4)$

I. C. (4) CONTENT: Real Number System; Algebraic Expressions; Synthetic Division and Evaluating

OBJECTIVE: The student will be able to use synthetic division to divide polynomials.

ACTIVITIES:

Use synthetic division to find the quotient and remainder.

(a) (a) $(x^4 + 6x^3 - 7x^2 - 7x - 1) \div (x + 3)$

(b) $(8 - 2x^2 - x^3) \div (x - 2)$

(c) $(x^4 - 1) \div (x - 1)$

(d) $(16 - 2x^2 - 3x^4) \div (x - 5)$

(e) $(x^3 - 2ix^2 - ix + 5) \div (x - i)$

(f) $(2x^3 - 5x^2 - 4x + 3) \div (x - \frac{1}{2})$

I. C. (5) CONTENT: Real Number System; Algebraic Expressions; Simplifying Expressions

OBJECTIVE: The student will be able to simplify and evaluate algebraic expressions for given values of the variables.

ACTIVITIES:

(a) Evaluate $4x^2 + 3x - 5$ for $x = -2$.

(b) Evaluate $a^2 - b^2$ for $a = 1$ and $b = -2$.

Simplify.

(c) $(5x^2 - 6x + 3) + (4x^2 - 5x - 4) - (-3x^2 - x + 8)$

(d) $9 + \{3 + (7 + y)\}$

(e) $3x^2 - \{9x - (4x - x^2) + 8\}$

(f) $10y - 2\{4 - 3\boxed{y} - 5(2 - 3\boxed{y})\}$

I. C. (6) CONTENT: Real Number System; Algebraic Expression; Simple Equations and Inequalities

OBJECTIVE: The student will be able to use axioms of real numbers to find the solution set for simple equations and inequalities.

ACTIVITIES:

(a) Find the solution set.

(1) $3x + 2 = x + 5$

(2) $4x + 4 = 2x + 2$

(3) $4(x - 6) = 3(x + 2)$

(4) $3 - \frac{1}{2}(4x + 2) = 6x$

(5) $\frac{2x}{3} - \frac{1}{2} = \frac{2x + 5}{6}$

(6) $(x + 2)(x - 2) - 2x = (x + 5)(x - 3)$

(7) $2\{5x - 2(x - 3)\} = 3x + 7$

(b) Graph the solution set on a number line.

(1) $x \leq 5$

(2) $5 \leq -3x - 13$

(3) $3(x - 2) < 3x + 5$

(4) $-3 < \frac{2}{3}p - 1$

I. D. (1) CONTENT: Real Number System; Factoring; Special Products

OBJECTIVE: The student will be able to determine special products.

ACTIVITIES: Find the product.

(a) $(x + 3)^2$

(b) $(x + 7)(x - 7)$

(c) $(x + 2)^3$

(d) $(x - 3)^3$

(e) $(x - 5)^3$

(f) $(x - 2)(x^2 + 2x + 4)$

(g) $(x + 1)(x^2 - x + 1)$

(h) $(x + y)(a + b)$

(i) $(a + b + 1)(a + b - 1)$

I. D. (2) CONTENT: Real Number System; Factoring; Prime Factorization

OBJECTIVE: The student will be able to factor selected polynomials.

ACTIVITIES: Factor each polynomial into the product of primes.

(a) $3x^2 - 6x - 9$

(b) $x^3 - 1$

(c) $x^3 - x^2 - 4x + 4$

(d) $4x^2y - 16d^2y$

(e) $x^2 + 2xy + y^2 - 9$

(f) $10x^2 + 35x - 75$

(g) $6 - y - y^2$

(h) $x^6 + 64y^6$

(i) $(a^2 - b^2) - (a - b)^2$

I. D. (3) CONTENT: Real Number System; Factoring; Remainder and Factor Theorem.

OBJECTIVE: The student will be able to apply the Remainder and Factor Theorem.

ACTIVITIES:

(a) Use the Remainder Theorem to find the remainder.

(1) $(5x^4 + 10x^3 - 7x^2 + 8x - 4) \div (x + 3)$

(2) $(x^{99} - 99) \div (x + 1)$

(3) $(x^6 + r^6) \div (x + r)$

(b) Use the Factor Theorem to show that the first polynomial is a factor of the second polynomial.

(1) $x + 1$; $x^3 - 7x - 6$

(2) $x - 3$; $x^4 + 3x^3 - 6x - 18$

II. A. (1) CONTENT: Equations and Inequalities; Equations; Linear Solutions and Graphs

OBJECTIVE: The student will be able to find three ordered pairs that satisfy a linear equation in two variables and graph.

ACTIVITIES: Find the solution set and graph.

(a) $x + y = 7$

(b) $x - y = -4$

(c) $x = -3$

(d) $y = 5$

(e) $x + 2y = 6$

(f) $-3x - 2y = -2$

II. A. (2) CONTENT: Equations and Inequalities; Equations; Slope of Segments and Lines

OBJECTIVE: The student will be able to find the slope of lines and segments.

ACTIVITIES:

(a) Find the slope of the segment whose endpoints have the following coordinates.

(1) (2,4) and (6,8)

(2) (-1,2) and (-3,-4)

(3) (3,3) and (-4,3)

(4) (2,5) and (2,-5)

(5) (-2,6) and (-4,6)

(b) Find the slope of the line.

(1) $3x - 4y = 2$

(2) $x + y = 6$

(3) $x = 3$

(4) $x = 5$

II. A. (3) CONTENT: Equations and Inequalities; Equations; Graphs of Lines

OBJECTIVE: The student will be able to graph a line given:

(a) The slope of a line and its y-intercept;

(b) A point of the line and its slope.

ACTIVITIES:

(a) Graph the line that has the indicated slope and y-intercept

(1) $m = 3$; $b = 2$

(2) $m = -\frac{3}{4}$; $b = -4$

(3) $m = 0$; $b = 0$

(b) Graph the line that contains the given point and has slope m.

(1) $P(-2,-4)$; $m = 2$

(2) $P(-3,4)$; $m = -\frac{2}{3}$

(3) $P(1,2)$; $m = 0$

II. A. (4) CONTENT: Equations and Inequalities; Equations; Equations of Lines

OBJECTIVE: The student will be able to find an equation of a line given:

(a) The slope of the line and its y-intercept;

(b) The coordinates of two points of the line;

(c) The coordinates of a point of the line and its slope.

ACTIVITIES:

(a) Find an equation of the line given that m and b are the slope and y-intercept respectively.

(1) $m = 3$; $b = 2$

(2) $m = -\frac{3}{4}$; $b = -3$

(b) Find and equation of $\overleftrightarrow{PQ}$ given that:

(1) $P(5,2)$ and $Q(-3,5)$

(2) P(8,1) and Q(7,-2)

(3) P(-2,3) and Q(-2,4)

(4) P(3,-2) and Q(4,-2)

(c) Find an equation of the line that contains P and has slope m.

(1) P(3,-2); $m = 4$

(2) P(5,-8); $m = -\frac{2}{3}$

(3) P(-2,4); $m = 0$

II. A. (5) CONTENT: Equations and Inequalities; Equations; Parallel and Perpendicular Lines

OBJECTIVE: The student will be able to:

(a) Find an equation of a line parallel to a given line;

(b) Find an equation of a line perpendicular to a given line.

ACTIVITIES:

(a) Find an equation of the line that contains P(-1,2) and is parallel to the line that contains Q(-3,1) and P(-2,3).

(b) Find an equation of the line that contains P(-2,-1) and is parallel to the graph of $2x + 3y = 6$.

(c) Find an equation of the line that contains P(2,1) and is perpendicular to the graph of $x + 2y = 6$.

(d) The vertices of a quadrilateral are P(-5,-2), Q(-4,2), R(4,6) and S(3,2). Prove that the quadrilateral is a parallelogram.

II. A. (6) CONTENT: Equations and Inequalities; Equations; Classification of Linear Systems

OBJECTIVE: The student will be able to classify a system of two linear equations in two variables as consistent, dependent, or inconsistent and give a geometric interpretation of each classification.

ACTIVITIES:

(a) Determine whether the equations in each system are consistent, inconsistent or dependent.

(b) State whether the graphs of the equations of each system intersect, are parallel, or coincide.

(c) Find the number of ordered pairs contained in the solution set of each system.

(1) $3x - y = 6$
$y = 3x + 2$

(2) $2x - 3y = 12$
$4 + y = \frac{2}{3}x$

(3) $x + 4y = 7$
$x = 2y + 1$

II. A. (7) CONTENT: Equations and Inequalities; Equations; Solution of Linear Systems

OBJECTIVE: The student will be able to determine the solution set of a system of two linear equations in two variables.

ACTIVITIES:

(a) Solve by addition or subtraction.

$3x + 2y = 10$
$x + 2y = 6$

(b) Solve by substitution.

$4x + 3y = 27$
$9x - 5y = 2$

(c) Solve by any method.

$4x + 7y = 12$

$\frac{1}{2} + 5y = 2$

(d) Solve by addition and substitution.

(1) $x + 2y + 3z = 10$

(2) $2x - y + z = 5$

(3) $3x - 3y + 2z = 5$

(e) Solve by substitution.

(1) $3x + 2y + z = 5$

(2) $5x + 3y - z = -4$

(3) $2x + 5y - z = -16$

II. A. (8) CONTENT: Equations and Inequalities; Equations; Rational Expressions

OBJECTIVE: The student will be able to perform fundamental operations on fractions.

ACTIVITIES:

(a) Reduce:

(1) $\frac{ax - ay}{bx - by}$

(2) $\frac{18x^2 - 32y^2}{6x^2 - xy - 12y^2}$

(b) Perform the indicated operations.

(1) $\frac{x^2 - 3x - 18}{x^2 - 9} \cdot \frac{6 - 2x}{x - 6}$

(2) $\frac{2x^2 - 18}{x^2 + 6x - 7} \div \frac{8x^2 + 4x - 24}{x^2 - 1}$

(3) $\frac{x^2 - 3x + 2}{x^2 - 1} \div \frac{2 - x}{x - 1}$

(c) Perform the indicated operations.

(1) $\frac{3}{x^2y} - \frac{2}{xy^2}$

(2) $\frac{6}{a + b} - \frac{4}{3a^2 - 3b^2}$

(3) $\frac{2x + 7}{x^2 - 2x - 15} - \frac{3x - 4}{x^2 - 7x + 10}$

(4) $3 + \frac{2}{3x + 6} - \frac{x - 3}{4 - x^2}$

(d) Simplify.

(1) $\dfrac{\dfrac{a^2 - b^2}{a}}{a - \dfrac{b}{a}}$

(2) $\dfrac{\dfrac{1}{x} + \dfrac{1}{y}}{\dfrac{x + y}{xy}}$

(3) $\dfrac{\dfrac{b-1}{b+3} - 1}{\dfrac{b+3}{b-3} + \dfrac{2}{b+3}}$

II. A. (9) CONTENT: Equations and Inequalities; Equations; Fractional Equations

OBJECTIVE: The student will be able to solve fractional equations.

ACTIVITIES:

(a) Find the value of x, if any, for which each fraction is undefined.

(1) $\dfrac{1}{x}$ (2) $\dfrac{x}{x-2}$ (3) $\dfrac{x+5}{x^2-25}$

(4) $\dfrac{2x}{x^2+4}$

(b) Solve and check.

(1) $\dfrac{x}{2} = \dfrac{1}{3}$

(2) $\dfrac{1}{2x} + \dfrac{5}{8} = \dfrac{3}{x}$

(3) $\dfrac{5x}{4} - 1 = \dfrac{7x}{3} - \dfrac{19}{6}$

(4) $\dfrac{3x+4}{x+2} - \dfrac{3x-5}{x-4} = \dfrac{12}{x^2-2x-8}$

(5) $\dfrac{\dfrac{x}{x-1} - 1}{\dfrac{x}{x-1} + 1} = \dfrac{\dfrac{x}{x+1} + 1}{\dfrac{x}{x+1} - 1}$

(c) Write an equation to solve each of the following:

(1) A number increased by $\frac{1}{4}$ of itself is 15. Find the number.

(2) At what time between 6 and 7 o'clock will the hands of the clock be together?

(3) A number is equal to its reciprocal. Find the number.

(4) While in college, Jim spent $\frac{3}{7}$ of his yearly allowance for room and board and $\frac{2}{7}$ for tuition. He used the remaining $1,000 for other expenses. What was his yearly allowance?

II. A. (10) CONTENT: Equations and Inequalities; Equations; Applications

OBJECTIVE: The student will be able to translate verbal expressions to algebraic equations.

ACTIVITIES:

Solve:

(a) Two angles are complementary and one is four times the other. Find the angles.

(b) Bill said, "Twice my age and five years is my father's age. How old am I if the sum of our ages is 35 years?"

(c) Joe has $5.40 in nickels and quarters. If he has 40 coins in all, how many nickels does he have?

(d) How much solution containing 15% alcohol can be made from 7.5 quarts of pure alcohol?

(e) Two cars leave the same place at the same time traveling in opposite directions. The first car averages 38 miles per hour and the second car averages 42 miles per hour. In how many hours are the two cars 200 miles apart?

(f) A dealer paid $24 for a chair. He wishes to make a profit of $33\frac{1}{3}\%$ of the cost price, yet sell it at a discount of 20%. What price should he mark it for sale?

(g) Joe can mow a lawn in 20 minutes and John can mow it in 30 minutes. How long would it take them to mow the lawn if they worked together?

(h) A boat that can travel 8 miles per hour in still water can travel 15 miles downstream in the same time it takes to travel 9 miles upstream. Find the rate of the stream.

II. B. (1) CONTENT: Equations and Inequalities; Inequalities; Linear Inequalities

OBJECTIVE: The student will be able to solve and graph linear inequalities.

ACTIVITIES: Solve and graph the solution set on a two dimensional coordinate system.

(1) $x + 8 \geq 3$

(2) $5x + 2y \leq -10$

(3) $2y - 3x > 6$

(4) $-2 \leq y \leq 3$

(5) $|x| + |y| \leq 2$

II. B. (2) CONTENT: Equations and Inequalities; Inequalities; Systems of Linear Inequalities

OBJECTIVE: The student will be able to find the solution set of a system of linear inequalities by graphing.

ACTIVITIES:

Graph the solution set of each system of inequalities.

(a) $x + y > 4$ and $x - y > 2$

(b) $2x + 3y > 5$ or $3x + 2y > 6$

(c) $x + 7y > 5$ and $2x + y < 7$

(d) $4x - y > 0$ and $x + 3y = 5$

(e) $2x + 5y < 7$ and $2x - y = 9$

II. B. (3) CONTENT: Equations and Inequalities; Inequalities; Rational Inequalities

OBJECTIVE: The student will be able to find the solution set of rational inqualities.

ACTIVITIES:

Find the solution set.

(a) $\frac{3}{x} < -2$

(b) $\frac{4}{x-3} \geq 2$

(c) $\frac{x-2}{x+3} \leq -1$

II. B. (4) **CONTENT:** Equations and Inequalities; Inequalities; Absolute Value Inequalities

OBJECTIVE: The student will be able to find the solution set of inequalities that involve absolute value.

ACTIVITIES:

Find the solution set.

(a) $|x - 3| = 4$

(b) $|x - 4| < 2$

(c) $|2x - 3| \geq 5$

(d) $|5x + 1| \leq \frac{9}{5}$

(e) $|4x + 2| > -5$

(f) $|4x - 2| < -5$

III. A. (1) **CONTENT:** Complex Number System; Roots and Radicals; Real Roots and Principal Root

OBJECTIVE: The student will be able to determine if a real number "a" has real nth roots (for a positive inter n), and if it does, identify the principal nth root.

ACTIVITIES:

Identify the principal root of each number, if it exists.

(a) $\sqrt[3]{64}$

(b) $\sqrt[5]{-1}$

(c) $\sqrt[7]{128}$

(d) $\sqrt[4]{\frac{81}{25}}$

III. A. (2) **CONTENT:** Complex Number System; Roots and Radicals; Simplifying Radicals

OBJECTIVE: The student will be able to simplify radicals.

ACTIVITIES:

Simplify.

(a) $\sqrt{8}$

(b) $\sqrt{72\ ax^2}$

(c) $\frac{1}{3}\sqrt{45a^5}$

(d) $\sqrt{-\frac{1}{2}}$

(e) $(5\sqrt{3})\ (7\sqrt{6})$

(f) $(\sqrt{a-b})\ (\sqrt{a-b})$

(g) $(\sqrt{5} - \sqrt{3})(\sqrt{5} + 3\sqrt{3}$

(h) $(2\sqrt[3]{9})\ (\sqrt[3]{3})$

(i) $\frac{2\sqrt{3} - \sqrt{5}}{2\sqrt{3} + \sqrt{5}}$

(j) $(\sqrt{3x^3})\quad(\sqrt{27x^7})$

(k) $\sqrt{\frac{3}{2x}}$

(l) $(\sqrt{6xy})\ (\sqrt{4x^3y^2})$

(m) $3\sqrt{2} + \sqrt{18} + 5\sqrt{8}$

(n) $\frac{3}{\sqrt[3]{3x^2}}$

(o) $\sqrt{\frac{12x^2y}{5x^3y^3}}$

(p) $\sqrt[4]{9x^2}$

III. B. (1,2)

CONTENT: Complex Number System; Imaginary Numbers; Definition and Operations

OBJECTIVE: The student will be able to:

(a) Define a pure imaginary number;

(b) Perform operations on pure imaginary numbers.

ACTIVITIES:

(a) Express each number in terms of i.

(1) $\sqrt{-5}$

(2) $-\sqrt{-36}$

(3) $\sqrt{-160}$

(b) Multiply.

(1) $(6i)(3i)$

(2) $\sqrt{-3}(3i)$

(3) $(\sqrt{-3})(\sqrt{-6})$

(c) Simplify.

(1) i^8

(2) i^{23}

(3) i^{34}

(4) $\frac{1}{i^5}$

III. C. (1) CONTENT: Complex Number System; Complex Numbers; Definition and Classification

OBJECTIVE: The student will be able to:

(a) Define a complex number;

(b) Classify any complex number as pure imaginary, real, or non-pure imaginary;

(c) Add, subtract, multiply and divide complex numbers.

ACTIVITIES:

(a) Express each of the following in standard (rectangular) form.

(1) $\sqrt{-3} - 2\sqrt{-27}$

(2) $(\sqrt{-5})(\sqrt{-2})$

(3) $(4i^3)(-2i^2)$

(4) $\frac{3}{i}$

(5) $\frac{1}{14i}$

(b) Simplify and write the answer in standard form.

(1) $(4 - \sqrt{-5}) + (15 + \sqrt{-2})$

(2) $2\sqrt{-25} - (2 - \sqrt{-36})$

(3) $(6i)(3i)$

(4) $(2 + 5i)^2$

(5) $\frac{2-\sqrt{-3}}{3+\sqrt{-3}}$

III. C. (2) CONTENT: Complex Number System; Complex Numbers; Solutions of Quadratic Equations

OBJECTIVE: The student will be able to solve a quadratic equation in one variable by:

(a) Factoring;

(b) Completing the square;

(c) Quadratic Formula.

ACTIVITIES:

(a) Remember that for all real numbers a and b, $ab = 0$ if and only if $a = 0$ or $b = 0$. Solve $y^2 + 10 = 7y$ by factoring and check.

(b) Solve $2x^2 - 3x - 2 = 0$ by completing the square.

(c) (1) Derive the quadratic formula by completing the square on $ax^2 + bx + c = 0$.

(2) Use the quadratic formula to solve $2x + 2 = 5x$.

(d) Supply the missing information to make each expression a square trinomial.

(1) $x^2 + 4x + _____$

(2) $x^2 - 3x + _____$

(3) $x^2 - \frac{1}{2}x + _____$

(4) $4x^2 + 3x + _____$

(e) Find the roots of each quadratic equation by completing the square.

(1) $x^2 + 3x = 40$

(2) $3x^2 - 6 = x$

(3) $\frac{3}{x-2} - \frac{1}{x-1} = 2$

(4) $x^2 + 2x + 4 = 0$

(f) Solve part (b) by using the quadratic formula.

III. C. (3) CONTENT: Complex Number System; Complex Numbers; Quadratic Inequalities

OBJECTIVE: The student will be able to solve and graph quadratic inequalities.

ACTIVITIES: Find the solution set.

(a) $(x + 3)(x - 4) \geq 0$

(b) $x^2 - x - 6 < 0$

(c) $(x - 2)(x + 5)(x - 4) \leq 0$

III. C. (4) CONTENT: Complex Number System; Quadratic Equations; Discriminant

OBJECTIVE: The student will be able to find the discriminant of a quadratic equation and use it to determine the nature of roots.

ACTIVITIES:

(a) Use the discriminant to determine the nature of the roots of:

(1) $9x^2 - 12x + 4 = 0$

(2) $x^2 + 5x + 8 = 0$

(3) $x^2 + 12 = 8x$

(b) Find a value of k so that $x^2 - 6x + k = 0$ has:

(1) equal roots.

(2) imaginary roots.

(3) real, rational, and unequal roots.

(4) real, irrational and unequal roots.

III. C. (5) CONTENT: Complex Number System; Quadratic Equations; Root-Coefficient Relations

OBJECTIVE: The student will be able to find the sum and product of roots of quadratic equations by using root-coefficient relations.

ACTIVITIES:

(a) Find the sum and product of the roots of:

(1) $3x^2 + 7x + 3 = 0$

(2) $4x^2 - 3x = 9$

(3) $8x = 2 - x^2$

(4) $x^2 + cx = 5$

(b) Is $\{3 + \sqrt{2}, 3 - \sqrt{2}\}$ the solution set of $x^2 - 6x + 7 = 0$?

III. C. (6) CONTENT: Complex Number System; Quadratic Equations; Determination from Roots

OBJECTIVE: The student will be able to write a quadratic equation given its roots.

ACTIVITIES:

(a) Find a quadratic equation whose roots are:

(1) 2 and -2

(2) $-\frac{2}{5}$ and $\frac{6}{5}$

(3) $\sqrt{2}$ and $3\sqrt{2}$

(4) -3

(5) $2 \pm 3i$ and $2 - 3i$

(b) Find a quadratic equation so that the sum of its roots is -5 and the product of its roots is $-\frac{1}{2}$.

III. D. **CONTENT:** Complex Number System; Radical Equations

OBJECTIVE: The student will be able to solve equations that contain one or more radicals.

ACTIVITIES:

Find the solution set.

(a) $x - 3\sqrt{x} = 4$

(b) $\sqrt{2x - 4} + \sqrt{x} = 2$

(c) $\sqrt{y-5} + 7 = y$

(d) $x^{\frac{2}{5}} - x^{\frac{1}{5}} = 2$

(e) $(x^2 - 1)^2 - (x - 1) = 2$

III. E. **CONTENT:** Complex Number System; Variations

OBJECTIVE: The student will be able to solve simple problems involving direct and inverse variations.

ACTIVITIES: Solve the following:

(a) If y varies directly as x and $y = 26$ when $x = 2$ find y when $x = 3$.

(b) A broker makes a commission of \$1248 on a sale of \$10,400. At the same rate, what would be her commission on a sale of \$8,000.

(c) If x varies inversely as t, and $x = 8$ when $t = 6$, find t when $x = 12$.

(d) If x varies inversely as $\sqrt{y}$ and if $x = 6$ when $y = 9$, find x when $y = 16$.

IV. A. (1,2) **CONTENT:** Relations, Functions and Conic Sections; Relations and Functions; Definition and Identification; Graphing

OBJECTIVE: The student will be able to:

(a) Define, identify and illustrate a relation; a function; the domain and range of a function;

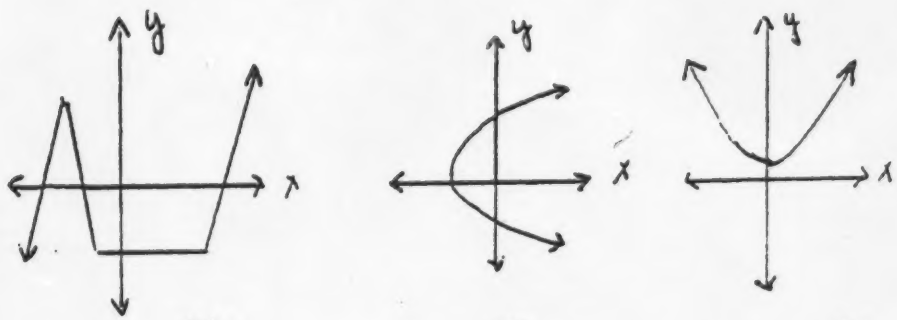
(b) Sketch the graphs of selected functions and relations.

ACTIVITIES:

(a) Matching:

(1)	Relation	i.	The set of all first coordinates.
(2)	Function	ii.	A relation which assigns to each element in the domain exactly one element of the range.
(3)	Domain	iii.	The set of all second coordinates.
(4)	Range	iv.	Any set of ordered pairs.

(b) Which of these graphs illustrate functions?



(1) (2) (3)

(c) Sketch the graph of each of the following:

(1) $5x + 3y = 9$

(2) $y = 1 + x^2$

(3) $y = 1 + |x|$

(4) $y = |x + 3|$

(5) $xy = x$

(6) $y^2 = x^2$

(7) $y^2 + x^2 = 0$

(d) Which of the graphs of part (c) illustrate functions?

IV. B. (1) CONTENT: Relations, Functions and Conic Sections; Polynomial Functions; Definition

OBJECTIVE: The student will be able to define a polynomial function and determine its degree.

ACTIVITIES: Find the degree of each term and the degree of each polynomial.

(a) $6x^2 - 8x^2y^2 - 17xy - 24xy^2z^4 + 2y + 3$

(b) $2y + 4 - 5x + 7x^2y^3z^2 + 5xy^2$

(c) $(x^2 + 3x + 2)^2$

(d) 3

(e) 0

IV. B. (2) CONTENT: Relations, Functions, and Conic Sections; Polynomial Functions; Operations

OBJECTIVE: The student will be able to perform the four basic operations.

ACTIVITIES:

(a) Perform the indicated operations given:

$f(x) = 3x-7$

$g(x) = 4x+1$

(1) $f(-2)$

(2) $g(3)$

(3) $(f+g)(x)$

(4) $(f-g)x$

(5) $f.g(x)$

(6) $\frac{f}{g}(x)$

(b) Given

$h(x) = 2x$

$j(x) = x-2$

Find:

(1) $h(j(x))$

(2) $j(h(x))$

(3) $h(j(5))$

(4) $j(h(-3))$

(c) Given: $t(x) = 5x - 9$

Find:

(1) $t^{-1}(x)$

(2) $t^{-1}(2)$

(3) $t(t(t^{-1}(x))$

IV. C. (1, 3) CONTENT: Relations, Functions and Conic Sections; Conic Sections; Concepts and Identification

OBJECTIVE: The student will be able to:

(a) Visualize a conic section as the intersection of a plane and a cone;

(b) Determine if the graph of a quadratic equation in two variables is a parabola, a circle, an ellipse or a hyperbola.

ACTIVITIES:

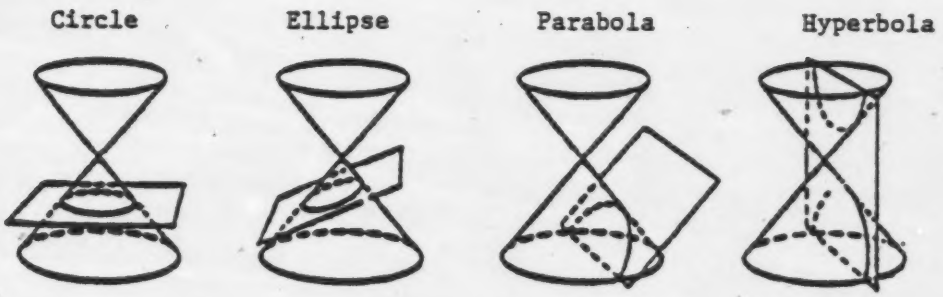
(a) Identify the standard form of an equation of:

(1) a circle

(2) an ellipse

(3) a parabola

(4) A hyperbola



(b) Write each equation in standard form and identify the graph.

(1) $256x^2 - 144y^2 = 2304$

(2) $y^2 = 25 - x^2$

(3) $y = x^2 + 3x - 4$

(4) $4x^2 + 3y^2 = 12$

(5) $y^2 = 36 + 4x^2$

(6) $y^2 + 4y + 2x = 6$

(7) $4x^2 + 4y^2 + 12y - 48 = 24x$

IV. C. (2) CONTENT: Relations; Functions and Conic Sections; Conic Sections; Distance and Midpoint Formulas

OBJECTIVE: The student will be able to:

(a) Find the distance between two points;

(b) Find the coordinates of the midpoint of a segment.

ACTIVITIES:

(a) Find PQ if:

(1) P(5,1) and Q(5,-11)

(2) P(-3,8) and Q(2,4)

(3) P(1,1) and Q(7,5)

(4) P(a,-b) and Q(-a,b)

(b) Find the coordinates of the midpoint of $\overline{PQ}$ if:

(1) P(2,4) and Q(4,8)

(2) P(3,-4) and Q(5,-2)

(c) Prove that A(2,-2), B(-1,1) and C(-5,5) are collinear.

(d) The vertices of a triangle are P(0,8), Q(-3,2) and R(10,2). Find the perimeter and area of the triangle.

IV. C. (4,5) CONTENT: Relations, Functions and Conic Sections; Conic Sections; Analysis

OBJECTIVE: The student will be able to analyze a quadratic equation that describes a conic section and where applicable, find:

(a) The coordinates of its center;

(b) The vertices;

(c) The foci;

(d) Equations of directrices;

(e) Equations of asymptotes;

(f) Equations of axes.

ACTIVITIES:

Use the equations of Part (b) of the previous section to answer the following:

(a) For each circle find:

(1) the coordinates of its center;

(2) the length of the radius.

(b) For each ellipse, find:

(1) the coordinates of the center;

(2) the coordinates of the x and y-intercepts and the foci;

(3) the major and minor axes.

(c) For each parabola, find:

(1) the coordinates of the vertex, focus and endpoints of the latus rectum;

(2) an equation of the axis of symmetry;

(3) an equation of the directrix.

(d) For each hyperbola, find:

(1) the coordinates of the vertices and foci;

(2) equations of the asymptotes.

IV. C. (6) CONTENT: Relations, Functions and Conic Sections; Conic Sections; Equations

OBJECTIVE: The student will be able to find equations of conic sections from given data.

ACTIVITIES:

(a) Write an equation for each circle.

(1) Center P(0,0); radius of length 3

(2) Center P(-2,4); diameter of length 10

(b) Find the center and radius of the circle whose equation is:

(1) $x^2 + y^2 + 4y = 12$

(2) $x^2 + 6x + y^2 - 10y - 3 = 0$

(c) Write an equation for each ellipse.

(1) foci: (6,0) and (-6,0); sum of focal radi: 4

(2) y-intercept 3 and -3; major axis of length 8.

(d) Write an equation for each parabola.

(1) focus: (0,0); directrix: $x = -4$

(2) focus: (1,2); directrix: $y = 3$

(3) vertex: (2,3); focus: (6,3)

(e) Write an equation for each hyperbola.

(1) foci: (2,0) and (-2,0); slopes of asymptotes are 3 and -3.

(2) foci (0,-4) and (0,4); difference of focal radii: 10

IV. D. (1,2) CONTENT: Relations, Functions and Conic Sections; Solutions of Linear-Quadratic Systems; Graphical and Algebraic Methods

OBJECTIVE: The student will be able to find solutions of linear-quadratic equations in two variables graphically and algebraically.

ACTIVITIES: Solve graphically and algebraically.

(a) $y = x^2 - 5$
$y = 4x$

(b) $xy = 4$
$y = x + 1$

(c) $x^2 + y^2 = 16$
$2x - y = 3$

IV. E. (1) CONTENT: Relations, Functions and Conic Sections; Solutions of Quadratic Systems; Graphing Method

OBJECTIVE: The student will be able to find solutions (or approximate solutions) of systems of quadratic equations by graphing.

ACTIVITIES: Sketch the graph of each system of equations. Find the number of real solutions and approximate the coordinates of the points of intersection of the graphs of each system of equations.

(a) $2x^2 - y^2 = 4$

$x^2 + y^2 = 4x$

(b) $xy = 2$

$x^2 + y^2 = 5$

(c) $x^2 + 3y^2 = 7$

$x - y^2 = 1$

IV. E. (2) CONTENT: Relations, Functions and Conic Sections; Solutions of Quadratic Systems; Algebraic Methods

OBJECTIVE: The student will be able to use algebraic methods to find the solution set of systems of quadratic equations in two variables.

ACTIVITIES:

(a) Use algebraic methods to solve the system of equations in the previous section;

(b) Compare your solutions with those you obtained by graphing.

IV. F. CONTENT: Relations, Functions and Conic Sections; Quadratic Inequalities

OBJECTIVE: The student will be able to graph quadratic relations in two variables.

ACTIVITIES:

Graph each relation.

(a) $\{(x,y) \mid x^2 + y^2 < 4\}$

(b) $\{(x,y) \mid y > x^2 + 2x - 8\}$

(c) $\{(x,y) \mid 9x^2 + 4y^2 - 18x + 16y - 11 \leq 0\}$

(d) $\{(x,y) \mid 4x^2 - 9y^2 > 36\}$

(e) $\{(x,y) \mid x^2 + y^2 + 3y - 12 \geq 6x\}$

V. A. (1,2) CONTENT: Exponential and Logarithmic Functions; Exponential Functions; Definitions and Graphs

OBJECTIVE: The student will be able to define and graph exponential functions.

ACTIVITIES:

(a) Simplify.

(1) $12^2 \cdot 12^{-3}$

(2) $a^5 \cdot a^0$

(3) $\frac{x^2}{x^{-3}}$

(4) $27^{\frac{4}{3}}$

(5) $\frac{a^{\frac{1}{2}}}{a^{\frac{3}{4}}}$

(6) $(a^{\frac{1}{2}})$

(7) $(81)^{-\frac{3}{4}}$

(b) Write each number in scientific notation

(1) .0000325

(2) 28,000,000

(3) .0023

(c) Write as an Arabic Numeral

(1) 2.38×10^5

(2) 5.23×10^{-6}

(3) 23.2×10^{-2}

(d) Graph:

(1) $y = 2^x$

(2) $y = (\frac{1}{2})^x$

(3) $y = 3^{-x}$

(e) Use the graphs of d(1) and d(2) above to find an approximate value of:

(1) $2^{\frac{1}{3}}$

(2) $(\frac{1}{2})^{\frac{1}{3}}$

(3) $2^{\sqrt{2}}$

(4) $(\frac{1}{2})^{\sqrt{2}}$

(5) 2^3

(6) $(\frac{1}{2})^3$

V. B. (1,2) CONTENT: Exponential and Logarithmic Functions; Logarithmus; Definitions and Laws

OBJECTIVE: The student will be able to:

(a) Define logarithm to base b;

(b) Use the laws of logarithms to write expressions in exponential and logarithmic form.

ACTIVITIES:

(a) Supply the missing information.

(1) $\log_{10} 1 = ?$

(2) $\log_{10} .001 = ?$

(3) $\log_{10} 1000 = ?$

(b) Write each of the following in logarithmic form.

(1) $2^5 = 32$

(2) $10^3 = 1000$

(3) $10^{2} = \frac{1}{100}$

(4) $2^{\frac{1}{2}} = \sqrt{2}$

(5) $\frac{1}{16} = 2^{-4}$

(c) Find numerical values for each variable.

(1) $\log_2 16 = x$

(2) $\log_{\frac{1}{2}} 8 = x$

(3) $_2\log 2^4$

(4) $\log_3 N = -4$

(5) $\log_3 \frac{1}{27} = y$

(6) $\log_b 16 = -2$

(7) $\log_b (\frac{27}{8}) = 3$

(8) $\log_x 64 = 3$

(9) $\log_4 N = -\frac{5}{2}$

(10) $\log_8 4 = y$

(11) $\log_2 (3x-4) = 3$

(12) $\log_x 81 = -2$

(d) If $\log_a M = 2$ and $\log_a N = 4$, find

(1) $\log_a (MN)$

(2) $\log_a (\frac{M}{N})$

(3) $\log_a M^4$

(4) $\log_a M - \log_a N$

(5) $\log_a N + \log_a N$

(e) If $\log 2 = .3$ and $\log 3 = .47$, find

(1) $\log 6$

(2) $\log 8$

(3) $\log \sqrt[3]{2}$

(4) $\log 24$

(5) $\log \frac{2}{9}$

(6) $\log 5$

(7) $\log 250$

(f) Write each of the following as a single logarithm.

(1) $\log_2 a + \log_2 b + \log_2 c$

(2) $\frac{1}{2} \log_3 a - 2 \log_3 a^2$

(3) $\log_3 x + \log_3 y = \log_3 m$

(4) $\log_3 x - \log_3 y - \log_3 z$

(5) $3 \log_a x - 3 \log_a y$

V. B. (3) CONTENT: Exponential and Logarithmic Functions; Logarithms; Functions

OBJECTIVE: The student will be able to:

(a) Define a logarithmic function;

(b) Find the domain and range of a logarithmic function;

(c) Graph logarithmic functions.

ACTIVITIES:

(a) Graph.

(1) $y = \log_2 x$

(2) $y = \log_{\frac{1}{2}} x$

(3) $y = \log_{10} x$

(b) Identify the domain and range of the functions described in part (a).

V. B. (4) CONTENT: Exponential and Logarithmic Functions; Logarithms; Comparison of Graphs

OBJECTIVE: The student will be able to explain how the graphs of a logarithmic function and its inverse and related to the graph of $y = x$.

ACTIVITIES:

(a) Sketch the graphs of $y = 4^x$ and $\log_4 x = y$

(1) For what values of x is $\log_4 x$ positive?

(2) For what values of x is $\log_4 x$ negative?

(3) Find the domain and range of $\log_4 x$.

(4) For what values of y is $y = 4^x$ positive?

(5) For what values of y is $y = 4^x$ negative?

(6) Find the domain and range of $y = 4^x$.

(7) If $f(x) = 4^x$ and $g(x) = \log_4 x$, find $f\{g(2)\}$.

Find $f\{g(x)\}$.

(b) Sketch the graphs of both functions on the same set of axes.

(1) $y = 2^x$ and $y = \log_2 x$

(2) $y = (\frac{3}{2})x$ and $y = \log_{\frac{3}{2}} x$

(c) What point, if any, lies on the graphs of all three functions.

(1) $y = \log_2 x$

(2) $y = \log_3 x$

(3) $y = \log_{10} x$

V. B. (5) CONTENT: Exponential and Logarithmic Functions; Logarithms; Common Logarithms

OBJECTIVE: The student will be able to find the characteristic of common logarithms and use a table to determine the mantissa of logarithms.

ACTIVITIES:

(a) Between what two consecutive integers do the logarithms of the following numbers lie?

(1) 256

(2) 25

(3) 2

(4) .25

(5) .025

(b) Use a table to find:

(1) log 4.38

(2) log 4380

(3) log 0.03057

(4) log 8.254

(c) If log 9.56 = 0.9805, find:

(1) log 956

(2) log 0.00956

V. B. (6) CONTENT: Exponential and Logarithmic Functions; Logarithms; Antilogarithms

OBJECTIVE: The student will be able to find a number x, given the common logarithm of x.

ACTIVITIES:

(a) Given that log 1.03 = 0.0128, find r if log r is:

(1) 2.0128

(2) 0.0128-1

(b) Use a table to find x.

(1) log x = 2.8739

(2) log x = 0.8488-2

(3) log x = 7.8488-10

V. B. (7,8) CONTENT: Exponential and Logarithmic Functions; Logarithms; Applications and Logarithmic Equations

OBJECTIVE: The student will be able to:

(a) Use logarithms to perform various operations on numbers;

(b) Solve equations of the form $a^x = b$; a and b real numbers.

ACTIVITIES:

(a) Use logarithms to solve each of the following:

(1) $N = 6.25$

(2) $N = (1.06)^{19}$

(3) $N = 3^{4.6}$

(4) $N = \dfrac{(0.0926)(15.3)^3}{(0.827)}$

(5) $N = \sqrt{\dfrac{(47.9)(3.15)^3}{7320}}$

(6) $3^{x-3} = 2^x$

(7) $3^{2x+1} = 27^{x-2}$

(b) Find numerical values for log 6 and log 27.

(c) Solve.

(1) The growth rate for a certain culture is given by the equation $B(t) = (a).10^{.03t}$ where a is the bacteria count in the original culture and t is the time elapsed after the experiment began. If the original population of the culture is 58,000, what will the population count be after 3 hours? When was the population 87,000?

(2) The compound interest formula is $A = P(1 + \dfrac{0.01r}{n})^{nt}$ where P is the principal, r is the annual interest rate, n is the number of compound periods in a year and t is the number of years. If \$3,800 is invested for 7 years at 8½% compounded quarterly, what will the total amount be? What amount should be invested now at 8½% compounded quarterly to realize \$10,000 in 10 years?

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